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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/199,816	11/25/1998	MASATO SHIMADA	Q52241	4106

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EXAMINER
DICKENS, CHARLENE

ART UNIT	PAPER NUMBER
2855	

DATE MAILED: 09/05/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/199,816	SHIMADA ET AL.	
	Examiner	Art Unit	
	Ex. Dickens	2855	

-- The MAILING DATE of this communication appears on the cover sh et with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 June 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-55 and 64-67* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-55 and 64-67* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 November 1998* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

In view of the appeal brief filed on 6/4/03, PROSECUTION IS HEREBY REOPENED. New grounds of rejections are set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) request reinstatement of the appeal.

If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (37 CFR 1.130, 1.131 or 1.132) or other evidence are permitted. See 37 CFR 1.193(b)(2).
The applicants are strongly advised to use the proper symbols for the illustrated elements, i.e., a piezoelectric element is not metal but shaded as such, in accordance with MPEP. 608.02.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, 10-12, 20, 24, 40-46, 52, 52/1-4, 52/10-12, 52/24, 52/40-46, 53, 55 and 67 are rejected under 35 U.S.C. 102(b) as being anticipated by Hashizumi et al., EP 786,345. Regarding claim 1, Hashizumi et al. teaches in an ink jet recording head of the type having a flow passage formation substrate in which a pressure generation chamber is formed, said pressure generation chamber being in communication with a

nozzle opening, a diaphragm provided on said flow passage formation substrate, said diaphragm defining an interior wall of said pressure generation chamber, and a piezoelectric element provided on said diaphragm, said piezoelectric element having at least a lower electrode, a piezoelectric layer, and an upper electrode, the improvement comprising: at least one of the group consisting of said diaphragm VP and said piezoelectric element PZ, includes a compression film having a compressive stress (col. 10, lines 7, 8) , wherein at least a part of a thickness of said compression film is removed in an area opposed to said pressure generation chamber, thereby forming a removal part (Fig. 27). Regarding, claim 2, Hashizumi et al. teaches wherein the compression film is other than the piezoelectric layer (col. 10, lines 7, 8). Regarding claim 3, Hashizumi et al. teaches wherein the compression film has at least a part in the thickness direction removed only in a portion along margins of the pressure generation chamber on both sides of said piezoelectric element in a width direction thereof (Fig. 12). Regarding claim 4, Hashizumi et al. teaches wherein the compression film is a conductive film (col. 6, line 34) being placed between the lower electrode BE and the piezoelectric layer and made of a material substantially different from that of the lower electrode (col. 10, lines 7, 8). Regarding 10, Hashizumi et al. teaches wherein the compression film forms at least a part of an elastic film forming at least a part of the diaphragm (Fig. 12; col. 10, lines 7, 8). Regarding claim 11, Hashizumi et al. teaches wherein at least the residue of the compression film forming a part of the elastic film is made of a polycrystalline substance, i.e., silicon dioxide, (col. 10, lines 7, 8). Regarding claim 12, Hashizumi et al. teaches wherein the elastic film is made of the compression

film only (col. 10, lines 7, 8). Regarding claim 24, Hashizumi et al. teaches wherein the lower electrode on both sides of the piezoelectric layer in a width direction thereof is completely removed (Fig. 12). Regarding claim 40, Hashizumi et al. teaches wherein the elastic film forming at least a part of the diaphragm has at least a part in a thickness direction removed in an area which is opposed to the pressure generation chamber and is other than the piezoelectric layer (col. 10, lines 14, 17-19). Regarding claim 41, Hashizumi et al. teaches wherein the elastic film has at least a part in the thickness direction removed only in a portion along the margins of the pressure generation chamber on both sides of said piezoelectric element in the width direction thereof (Fig. 12; col. 10, lines 14, 17-19). Regarding claim 42, Hashizumi et al. teaches wherein said piezoelectric element is formed on the elastic film so as to extend to the portion with at least a part of the elastic film removed (Fig. 12). Regarding claim 43, Hashizumi et al. teaches wherein the piezoelectric layer forming said piezoelectric element is roughly uniformly thick (col. 9, lines 23, 24). Regarding claim 44, Hashizumi et al. teaches wherein an end of the extension of the piezoelectric layer forming said piezoelectric element to the portion with the part of the elastic film removed is thicker than other portions (col. 9, lines 23, 24, 29, 31). Regarding claim 45, Hashizumi et al. teaches wherein at least a part of the piezoelectric layer is formed across an area opposed to the pressure generation chamber (Fig. 12) and said piezoelectric element is formed by patterning only the upper electrode (col. 7, lines 19-25). Regarding claim 46, Hashizumi et al. teaches wherein the lower electrode BE is placed uniformly in an area opposed to said piezoelectric element and in other areas (Fig. 12). Regarding claim 52, Hashizumi

et al. teaches an ink jet recorder comprising an ink jet recording head (col. 19, lines 28, 29). Regarding claim 53, Hashizumi et al. teaches wherein said compression film is an elastic film BE and said lower electrode film is formed uniformly on said elastic film without patterning (col. 8, lines 39-43). Regarding claims 20, 55, Hashizumi et al. teaches wherein said first/lower electrode BE is said compression film. Regarding claim 67, Hashizumi et al. teaches wherein said compression film includes said compressive stress pre-established therein (col. 10, lines 7, 8).

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 5-9, 13-17, 19, 21-23, 25-39, 48, 50, 51, 51/5-9, 51/13-17, 51/19, 51/21-23, 51/25-39, 51/48, 52/5-9, 52/13-17, 52/19, 52/21-23, 52/25-39, 52/48, & 64-66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hashizumi et al. in view of Hasegawa et al., US Patent 5,719,607. Claims differ from Hashizumi et al. with the recitation of a conductive film is a film containing a second conductive film formed on the lower electrode and a first conductive film formed on the second conductive film and at least the second conductive film is a film made of a material different from that of the lower electrode and the types of material used for the conductive films. Regarding claims 5, 6, 7, 9, 14, 21, 22, 23, 37, 38, and 64, Hasegawa et al. discloses a conductive film is a film containing a second conductive film 210, made from platinum or an oxide (col. 7, lines 1-9), formed on the lower electrode 104, made from platinum, gold, an

oxide or a nitride (col. 6, lines 50-54), and a first conductive film 220, made from an alloy of metal selected from tantalum or an oxide (col. 7, lines 35-50), formed on the second conductive film and at least the second conductive film is a film made of a material different from that of the lower electrode for the purpose of improving the adhesion between the lower electrode and the piezoelectric film and exfoliation between the lower electrode and the piezoelectric film can thus be effectively prevented within a liquid jet head (col. 7, lines 29-33). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have conductive film is a film containing a second conductive film formed on the lower electrode and a first conductive film formed on the second conductive film and at least the second conductive film is a film made of a material different from that of the lower electrode in Hashizumi et al. as taught by Hasegawa et al. for the purpose of improving the adhesion between the lower electrode and the piezoelectric film and exfoliation between the lower electrode and the piezoelectric film can thus be effectively prevented within a liquid jet head (col. 7, lines 29-33). Regarding claims 8, 65,66, Hashizumi et al. and Hasegawa et al. disclose wherein the first conductive film is a film formed of a material, i.e., tantalum, for preventing lead contained in the piezoelectric layer from diffusing (col. 5, line 53-58; col. 6, lines 30-49, respectively). Regarding claim 13, Hasegawa et al. discloses an elastic film 103 is made of a film of multiple layers (Figs. 2-4). Regarding claim 15, Hashizumi et al. discloses a zirconium oxide film, i.e., zirconia, (col. 6, 30-32). Regarding claims 16, 17, Hashizumi et al. discloses a layer below the compression film is a layer made of a material different, metal, from the compression film in etching

characteristic and is not selectively etched (col. 8, lines 39-43). Regarding claim 19, Hasegawa et al. discloses wherein the elastic film contains a boron-doped silicon film on the pressure generation chamber side (col. 5, lines 54-56). Regarding claim 25, Hasegawa et al. discloses wherein the upper electrode is formed of the elastic film and is patterned together with the piezoelectric layer (col. 55-61). Regarding claim 26, the modified Hashizumi et al. is suggestive of a compression film having a compressive stress after said piezoelectric element is patterned (col. 10, lines 7,8). Regarding claim 27, the modified Hashizumi et al. is suggestive of an upper electrode comprises a metal material (col. 6, lines 42-44). Regarding claims 28, 29, Hasegawa et al. is suggestive of a film formed using etching, sputtering, or chemical vapor deposition, i.e., addition of inert gas, techniques (col. 8, lines 64-67), wherein Hashizumi et al. discloses etching to form a compressive film (col. 10, lines 7, 8). Regarding claim 30, Hasegawa et al. is suggestive of wherein at least one additive selected from metal, semimetal, semiconductor, and insulator different in constituent is added into the metal material (col. 6, lines 50-54; col. 7, lines 1-9 & 35-50). Hashizumi et al. discloses forming compression film, which has a compressive stress (col. 10, lines 7, 8).). Regarding claim 31, Hashizumi et al. discloses executing ion implantation (col. 7, line 47). Regarding claims 32, 33, Hasegawa et al. is suggestive executing solid-phase diffusion from a layer placed on an electrode (col. 6, lines 30-35) and wherein the solid-phase diffusion is executed by heating (col. 6, line 36-38) in an insert gas, which are used durning chemical vapor deposition. Regarding claims 34-36, Hasegawa et al. discloses an electrode structure (Figs. 3, 4) having a first electrode 106, made of metal, i.e.,

platinum, (col. 6, lines 50-54), formed on the surface of the piezoelectric layer 105 and a second electrode 104 deposited on the first electrode and the second electrode is a film made of metal oxide (col. 6, lines 50-54). Regarding claim 39, Hasegawa et al. is suggestive of layers formed of the metal oxide are formed by oxidation (col. 6, lines 10, 11). Regarding claim 48, Hasegawa et al. discloses detailed description of how to manufacture a piezoelectric element (col. 4, line 48 thru col. 5, line 49; col. 9, lines 30-66). One having ordinary skill in the piezoelectric art would find it obvious when a drive force load is imposed on said piezoelectric element, the element itself would experience stress equal to a stress at the piezoelectric layer formation time because the element is specifically manufactured to provide an optimum element. Regarding claim 50, Hashizumi et al. is suggestive of wherein an expansion force of a portion of the diaphragm opposed to said piezoelectric element in the area opposed to the pressure generation chamber is relatively smaller to the compression side than an expansion force in other than the area opposed to said piezoelectric element because Hashizumi et al discloses balancing the compression internal stress within a diaphragm and providing a ratio between the thickness of the piezoelectric element and diaphragm can be determined by experimentation to provide a target vibration characteristic (col. 10, lines 6-11). Regarding claims 51/5-9, 51/13-17, 51/19, 51/21-23, 51/25-39, 51/48, Hasegawa et al. is suggestive of the pressure generation chambers are foamed on a silicon monocrystalline (col. 4, line 6) substrate 101 by anisotropic etching (col. 10, lines 30, 39-45) and the layers of said piezoelectric element are formed by film forming and lithography process (col. 9, lines 30-66). Regarding claims 52/5-9, 52/13-17, 52/19,

52/21-23, 52/25-39, 52/48, Hashizumi et al. teaches an ink jet recorder comprising an ink jet recording head (col. 19, lines 28, 29).

Claims 18, 51/18 and 52/18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hashizumi et al. in view of Masahiro et al., JP 3-239554. Claim differs from Hashizumi et al. above with the recitation of a film having tensile stress. Masahiro discloses a film 31 having a tensile stress (abstract) for the purpose to avoid occurrence of tensile stress exceeding the allowable stress in a film and thus preventing the destruction of a vibrator due to temperature changes (abstract). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have a film having tensile stress in Hashizumi et al. as taught by Masahiro for the purpose to avoid occurrence of tensile stress exceeding the allowable stress in a film and thus preventing the destruction of a vibrator due to temperature changes (abstract).

Claims 47, 51/47, and 52/47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hashizumi et al. in view of Takeuchi et al., EP 718,900. Claim differs from Hashizumi et al. with the recitation of a diaphragm is deformed convex outwardly from the pressure generation chamber. Takeuchi et al. discloses a diaphragm 10 is deformed convex outwardly from the pressure generation chamber 6 (page 8, lines 33-35) for the purpose of providing a piezoelectric element which can efficiently convert stresses generated in the piezoelectric unit into a large amount of displacement upon application of a relatively low voltage, and does not suffer from considerable reduction in the amount of displacement where two or more piezoelectric units formed on respective diaphragm portions are actuated at the same time (page 3, lines 9-12). It

would have been obvious to one having ordinary skill in the art at the time the invention was made to have a diaphragm is deformed convex outwardly from the pressure generation chamber in Hashizumi et al. as taught by Takeuchi et al. for the purpose of providing a piezoelectric element which can efficiently convert stresses generated in the piezoelectric unit into a large amount of displacement upon application of a relatively low voltage, and does not suffer from considerable reduction in the amount of displacement where two or more piezoelectric units formed on respective diaphragm portions are actuated at the same time (page 3, lines 9-12).

Claims 49, 51/49, and 52/49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hashizumi et al. in view of Hasegawa et al. as applied to claims 1 & 48 in further view of Takeuchi et al., EP 718,900. Claim differs from the modified Hashizumi et al. with the recitation of a diaphragm is deformed convex outwardly from the pressure generation chamber. Takeuchi et al. discloses a diaphragm 10 is deformed convex outwardly from the pressure generation chamber 6 (page 8, lines 33-35) for the purpose of providing a piezoelectric element which can efficiently convert stresses generated in the piezoelectric unit into a large amount of displacement upon application of a relatively low voltage, and does not suffer from considerable reduction in the amount of displacement where two or more piezoelectric units formed on respective diaphragm portions are actuated at the same time (page 3, lines 9-12). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have a diaphragm is deformed convex outwardly from the pressure generation chamber in the modified Hashizumi et al. as taught by Takeuchi et al. for the

purpose of providing a piezoelectric element which can efficiently convert stresses generated in the piezoelectric unit into a large amount of displacement upon application of a relatively low voltage, and does not suffer from considerable reduction in the amount of displacement where two or more piezoelectric units formed on respective diaphragm portions are actuated at the same time (page 3, lines 9-12).

Claim 54 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hashizumi et al. in view of Takeuchi, US Patent 5,376,857 ('857). Claim differs from Hashizumi et al. with the recitation of ends of said piezoelectric element are extended to an area opposite to said removal part. '857 teach ends of said piezoelectric element 5 are extended (Figs. 1A-5) to an area opposite to said removal part 8 for the purpose of providing a novel piezoelectric device which can be readily manufactured with an improved productivity and which yet achieves satisfactory reliability and functions by avoiding short-circuit between the electrode layers while ensuring an unrestricted movement of the piezoelectric layer relative to the substrate (col. 2, lines 1-9). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have ends of said piezoelectric element are extended to an area opposite to said removal part in Hashizumi et al. as taught by '857 for the purpose of providing a novel piezoelectric device which can be readily manufactured with an improved productivity and which yet achieves satisfactory reliability and functions by avoiding short-circuit between the electrode layers while ensuring an unrestricted movement of the piezoelectric layer relative to the substrate (col. 2, lines 1-9).

Applicant's arguments with respect to claims 1-55 & 64-67 have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ex. Dickens whose telephone number is 703-305-7047. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Lefkowitz can be reached on 703-308-4816. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-3432 for regular communications and 703-305-3431 for After Final communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1782.

Cd/dickens
August 21, 2003

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